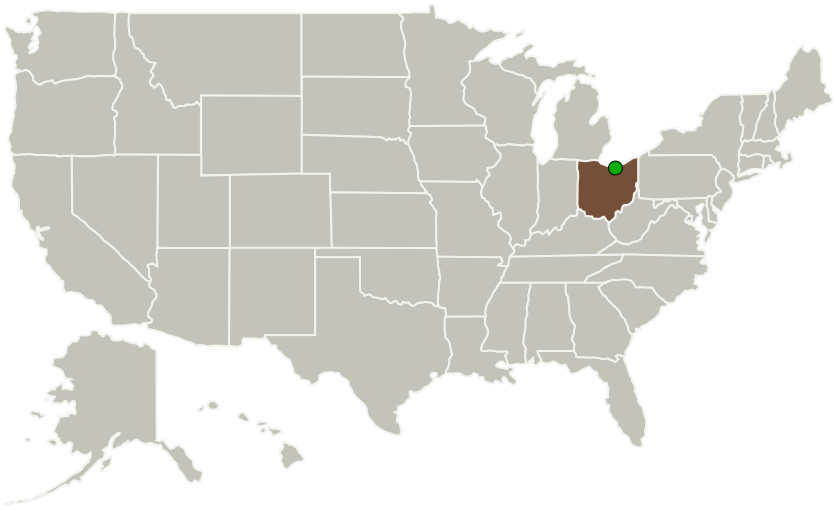
# Coupled Transpired and Discretely Injected Films, Phase I

Completed Technology Project (2011 - 2011)

## Project Introduction

NASA, and all users of turbomachinery, continuously requires improvements in engine durability and efficiencies. As combustion engineers push turbine inlet temperatures to new extremes, cooling designers are faced with increasing heat loads and less available coolant usage. Surface cooling techniques such as film cooling have proven invaluable in this quest. Films generated by forcing the coolant to bleed through a porous substrate have been shown to perform substantially better than discrete film injection in a thermal sense. However, the associated aerodynamic penalties limit the application. On the other hand, discretely injected films have drawbacks as well, including non-uniform coolant profiles significant mixing with the hot working fluid, lowering their effectiveness. Spectral Energies, LLC and the University of Central Florida propose a novel, low risk approach to surface cooling wherein traditional discrete film holes are embedded within a transpiring porous strip. The motivation behind this approach is multi-faceted, with the ultimate goal of developing a cooling arrangement which possesses the thermo-mechanical benefits of a transpired film, the aerodynamic benefits of discrete film injection, and mixing characteristics that are some compromise of the two.

## Primary U.S. Work Locations and Key Partners

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Spectral Energies, LLC | Lead Organization | Industry<br>Small Disadvantaged Business (SDB) | Dayton, Ohio |
| Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

| Primary U.S. Work Locations |
|---|
| Ohio |

## Project Transitions

**February 2011:** Project Start

**September 2011:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/138064)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Spectral Energies, LLC

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

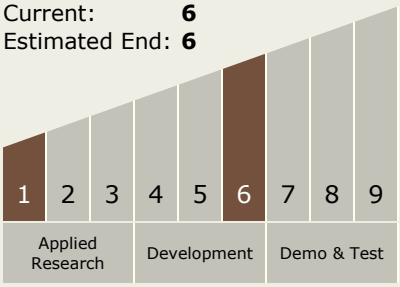
Carlos Torrez

**Principal Investigator:**

Sivaram Gogineni

## Technology Maturity (TRL)

Start: **1**
Current: **6**
Estimated End: **6**



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## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System